UNIVERSITY OF GONDAR
FACULTY OF VETERINARY MEDICINE

A STUDY ON THE PREVALENCE, RISK FACTORS AND FINANCIAL LOSE OF CATTLE, SHEEP AND GOATS FASCIOLOSIS SLAUGHTERED AT ELFORA ETHIOPIAN LIVESTOCK AND MEAT EXPORT INDUSTRIALIZED ABATTOIR IN DEBREZEIT TOWN, ETHIOPIA

DVM THESIS

BY
ZEMENE LAKEW

JUNE 2015
GONDAR, ETHIOPIA

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A thesis submitted to the Faculty of Veterinary Medicine, University of Gondar in partial fulfillment of the requirements for the degree of Doctor of Veterinary Medicine

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LIST OF ABBREVIATIONS

%	Percentage
CM	Cost of 1kg meat
°C	degree celcius
°E	degree east
°N	Degree north
ALC	Annual liver condemnation
AWA	Average weight loss of animal
CI	Confidence intervlal
CSA	Central statistic Authority
d	desired absolute precision
DVM	Doctor of veterinary medicine
ETB	Ethiopian birr
FH	Final host
GDP	Gross Domestic Product
IH	intermediate host
Km	killo meter
Mm	Millimeter
N	required sample size
Pexp	expected prevalence
SPSS	Statistical Package for the Social Sciences
USD	United states dollar
WHO	world health organization

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ABSTRACT

The study was designed with the aims of determining the prevalence and risk factors of Fasciolosis in cattle, sheep and goats slaughtered from December 2014 to March 2015 at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir in Debrezeit town, Ethiopia. 838 animals comprising of cattle (343), sheep (283) and goats (212) were subjected to routine post mortem examination for Fasciolosis. The overall prevalence of Fasciolosis in the study was 21.8%. The prevalence of Fasciolosis in young cattle, sheep and goats were 22.6%, 13% and 6.8% respectively and in adult cattle, sheep and goats were 38.3%, 26.9% and 12.8% respectively. Significantly higher ($p<0.05$) prevalence of Fasciolosis was seen in adult cattle, sheep and goats when compared to young ones. The prevalence of Fasciolosis was variable in different body condition scores and significantly higher ($p<0.05$) prevalence of Fasciolosis was observed in poor body condition cattle, sheep and goats. The high level of Fasciolosis in Ruminants in the present study represents high rate of infestation and immense economic losses to the country, Ethiopia. In this study, the total economic losses due to condemnation of infested livers and weight from the study species were estimated to be 17,239,862ETB/861,993.1USD. In line with this finding, it is recommended that farmers who rear cattle, sheep and goats should improve provision of feeds to their animals; be able to regularly treat their animals with the appropriate anthelementics and awareness should be created on the prevention and control methods of Fasciolosis.

Key words: *Prevalence, Fasciolosis, Cattle, Sheep and Goats, Debre Zeit.*

1. INTRODUCTION

Ethiopia is a home for many livestock species and suitable for livestock production and believed to have the largest livestock population in Africa. An estimate indicates that the country is a home for about 54 million cattle, 25.5 million sheep and 24.06 million goats. From the total cattle population 98.95% are local breeds and the remaining are hybrid and exotic breeds. 99.8% of the sheep and nearly all goat population of the country are local breeds (CSA, 2013).

Cattle, sheep and goat production are an important component of agriculture and rural development program in many countries; therefore, useful small scale efforts have been made to encourage sheep and goat intervention throughout the world. Ruminants have an enormous contribution to Ethiopia's national economy and livelihoods of many Ethiopians, and still promising to really round the economic development of the country (Tadele and Worku, 2007). Small ruminants plays vital roles in generating income to farmers, creating job opportunities, ensuring food security, providing services, contributing to asset, social, cultural and environmental values, and sustain livelihoods (Yilma and Malones, 2008). This subsector contributes about 16.5% of the national Gross Domestic Product (GDP) and 35.6% of the agricultural GDP (Metaferia *et al*., 2011). It also contributes 15% of export earnings and 30% of agricultural employment (Behnke, 2010). The livestock subsector currently support and sustain livelihoods for 80% of all rural population. The GDP of livestock related activities valued at birr 59 billion (Metaferia *et al*., 2011).

Despite high cattle, sheep and goat population and existing favorable environmental conditions, the current output of the country is little. This is associated with a number of complex and inter-related factors such as widespread diseases including helminthes, inadequate feed and nutrition, poor genetic potential of local breeds, market problem, and inefficiency of livestock development services with respect to credit, extension, marketing, and infrastructure (Benin *et al*. 2003; Negassa *et al*. 2011).

Helminthes are major obstacles in the growth and development of livestock and have great economic importance in terms of retarded growth, lowered productivity and mortality (Rubina *et al*., 2014; Yami and Merkel, 2008). Infections and parasitizes of ruminants can reduce meat or milk production and can lead to death or destruction of the animals, all of which diminishes the supply of

available food for man (Okewele *et al.*, 2000). These diseases are also an obstacle for international trade, as well as a serious financial drain for cattle farmers and, more broadly, for a community's or a country's economy, which can have wide repercussions for a society's health (Tsegaye *et al.*, 2012; WHO, 2005).

Among helminthes, Fasciolosis is an economically important parasitic disease, which is caused by trematodes of the genus Fasciola that migrate in the hepatic parenchyma and establish in the bile ducts (Aliyu *et al.*, 2014). Fasciola is commonly recognized as liver flukes and are responsible for wide spread morbidity and mortality in ruminants characterized by weight loss, anemia and hypoproteinemia (Nayab and Meral, 2010; Swanakar and Sagar, 2014).

It causes a substantial economic loss which includes death, loss in carcass weight, reduction in milk yield, condemnation of affected liver, decline production and productive performances, exposure of animals to other diseases due to secondary complications and cost of treatment expenses (Hussain *et al.*, 2010; Hansen and Perry, 2013).

The presence of Fasciolosis due to *F. hepatica* and *F. gigantica* at abattoir surveys in some parts of the country has long been known and its prevalence and economic significance have been reported by several workers (Tadele and Worku, 2007; Abunna *et al*., 2010). But there is still a gap for many potential sites of the country and information is not available to review country wide prevalence and economic significance of Fasciolosis in ruminants especially in small ruminants.

Therefore, the objectives of the study are:

- To estimate the prevalence and risk factors of Fascolosis.
- To assess the economic significance of cattle, sheep and goat Fasciolosis at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir.

2. LITERATURE REVIEW

2.1. Ethiology

Fasciola is a large fluke flattened trematode parasite which is flattened dorsoventerally, greyish brown in color. The adults *F. Hepatica* has a flat leaf like body, typically of fluke and measures 20 to 30 mm long by 8 to 15 mm wide (Ahmed *et al*., 2005) and boarder anteriorly than posteriorly with anterior cone shaped perception (Mesfin, 2004). Immediately below the anterior cone there is presence of broad area are called shoulder and it has taxonomic importance. Two suckers are presenting, oral and veternal (Mandal, 2006).

The ventral suckers are situated at the level of shoulders and is about as large as the oral. The tegument is armed with sharp spines. F. gigantic on the other hand very similar to F, Hepatica, it is length may vary from 25 to 75 mm long by 15 mm wide (Mesfin, 2004). The anterior cone is smaller than *F. Hepatica* and the shoulder is not so prominent and the body is more transparent (Soulsby, 2002). The eggs are typically these are oval and yellow in color. At one side there is presence of operculum (Mandal, 2006) for both *F. Hepatica* and *F. Gigantical* but the egg of *F. gigantical* is large up to 197 mm by 104 mm (Ahmed *et al.*, 2005; Aliyu *et al*., 2014).

2.2. Epidemiology

Fasciolosis is an important disease of ruminant in all countries where climatic condition suitable for the proliferation of host snails prevails (Neyab and Meral, 2010). *F. Hepatica* is the most common and important liver fluke and has a cosmopolitant distribution. Although it may infest all domestic species it is of economic importance only in sheep and cattle (Keyyu *et al.*, 2005). A high incidence has also been reported in donkeys in United Kingdom. The other animal's species may provide sources of re-infection for domestic ruminants (Radostits *et al.*, 2010).

There are three main factors influencing the productivity of large number of metacerceria necessary for out breaks of Fasciolosis; availability of suitable snails habitats, temperature and moisture such condition are also essential for the development of fluke egg, for meracidia searching for snail and for the dispersal of cercaria being shed from the snails (Graber, 2008), this fluke worldwide distribution occurs in areas where sheep, cattle, and goat are raised and there is a niche for lymnaeid

snails. It is generally agreed that F. Hepatica cause heavy economic losses in live stock world wide *F. Gigantica* is more common in Africa, India where it occurs commonly in goats and buffalo (Radostitis *et al*., 2010; Keyyu *et al.*, 2005).

2.3. Life cycle

The life history of F. Hepatic is typical of the family (Bowman, 2003). The parasite in the cattle and sheep (Definitive host) mature in the bile duct of the host and their eggs pass down to the bile ducts and are excreted with the feaces (Radostits *et al.*, 2010). Suitable climatic and environmental conditions are required for the presence and hatching of the eggs, viability of the meracidia and persistence of the snails. In general terms the life cycle is assisted at this point by warm, moist conditions and the presence of free surface water (Radostits *et al.*, 2009).

In the presence of the environmental factors like, humidity etc. the meracidium develops in the egg (Mandal, 2006). At 26^0c eggs can be hatched in 10-12 days producing the first larval stage, the meracidium.

The meracidium is broad anteriorly with a small papillaeform protrusion the tegument is ciliated and the organism has a pair of eye spots (Soulsby, 2002) for further development on amphibious snails of the genus lymnae is required (Intermediate hosts). One chemical is secedes by the snails (IH) and the meracidium follow this chemical and reaches the snails and penetrates the soft tissue of the snails (Mandal, 2006) and develops in to the sporocyst, which reaches a length over 1mm (Soulsby , 2002).

Several stages occur in the body of the snail like sporocyst, radia and cerceria. The cercria comes out the host snails. It has tail appendage and it can move from one plate to another pale and also can swim (Abu, 1999). The cercaria can crawl on the grass blades and aquatic vegetation, soon the cercaria loose their tail appendage and transform in to metacercaria which is the encysted stage formed by the secretion of cytogenous glands present in cercaria and the metacercaria is somewhat resistant to environment (Hammond and Sewell, 2004). Final host (FH) gets infection by ingestion of the metacercaria along with their food material and drinking water. After ingestion, excystation of metacercaria occurs. Then the immature flukes invade the intestinal wall and migrate through the peritoneal cavity and subsequently penetrate the liver capsule reaching the parenchymatous tissues

where are the flukes migrating for a long duration. Then finally these flukes reach the bile duct and get sexually matured (Mandal, 2006).

2.4. Pathogenesis

Essentially the pathogenesis is in the two phase, the first phase occurs during migration in the liver parenchyma and associated with liver damaged and Hemorrhage (Swanakar and Sagar, 2014). The seasons occur when the parasite is in the bile ducts and results from haematophagic activity of the adult flukes and from damage to the bile mucosa by their cuticular spine (Sileshi and Dessalegn, 2007). Acute and chronic Fasciolosis are caused by different stages of *F.Hepatica* in the liver. Acute Fasciolosis is caused by the sudden invasion of the liver by masses of young flukes; sufficient parenchyma may be destroyed to cause acute hepatic insufficiency (Radostits *et al.*, 2010). The time of death and severity of the damage are related to the number of metacercaria ingested death occurs earlier and the damage is related to the number of the flukes (Jithandran and Bhat, 1996). In sheep 1000 or more metacercaria ingested within a short period may cause death. Cattle are more resistance than sheep to the effect of flukes, 10,000 to 20,000 matacecaria were found to cause death. The most striking changed in acute Fasciolosis are seen in the liver (William *et al*., 2000).

Clinically chronic fasciolosis is characterized by progressive loss of condition and the development of anemia and hypoalbuminemia which can results in emaciation pallor of the mucus membranes, submandibular edema and ascites (Graber, 2008). Chronic hepatic Fasciolosis develops slowly and is the result of the activities of mature flukes in the bile duct. It is a combination of cholangitis, bilary obstruction and destruction of hepatic tissue with resultant fibrosis and liberation of a hemolytic toxin by the fluke (Radastits *et al.*, 2010).

2.5. Clinical sign

The clinical features of Fasciolosis can have acute, sub-acute and chronic forms (Graber, 2008). Clinical signs in acute stage; the animal dies suddenly, blood stained frothy appear at the nostrils and blood is discharged from the anus as in the case of anthrax (Soulsby, 2002). In sub acute case it is characterized by anemia, Jaundice and ill – thrift, the migrating flukes cause extensive tissue damage, hemorrhage and in particular liver damage (Radostits *et al.*, 2008).

Chromic fasciolosis is the most common clinical syndrome in sheep and cattle, chronic Fasciolosis occurs beyond 12 weeks post infections when the fluke have reached the bile ducts and are maturing sexually (Anne and Gray, 2006). Although production losses are the usual results of chronic infection death also occurs (William *et al.*, 2000).

Chronic Fasiciolisis is much more prolonged and "fluky" sheep lose weight, develop sub mandibular edema (bottle jaw) and pallor of the mucosa over a period of weeks. Diarrhea and shedding of the wool are common occurrence (Radostits *et al.*, 2009).

2.6. Diagnosis

This is based primarily on clinical signs, seasonal occurrence, and prevailing weather patterns and 2 previous histories of Fasciolosis on the farm or the identification of snail habits (Graber, 2008). In endemic areas, diagnosis may often be made on the basis of clinical sign such as loss of condition, anemia and failure to gain weight (William *et al.,* 2000). To support the diagnosis there should be fluke eggs in the faces and hepatic lesion characteristics of the disease in the liver at necropsy (Radostits *et al., 2010).*

Diagnosis is confirmed by finding the eggs in the faeces (Soulsby, 2002), the egg of fasciolosis are very much characteristics. It must be distinguished from the egg of other flukes, especially the large eggs of Paramphistomum. The Fasciola egg had a yellow shell with an indistinct operculum, and the embryonic cells are also rather in distinct. The Paraphistomum egg have transparent shells and distinct opercula, their embryonic cells are clear and there is frequently a small Knob at the posterior and pole which the eggs themselves are often larger than those of the liver fluke. Fasciola egg is Barrel- shaped, opercula egg does not reliably appear in flotation methods, and it is best to use sedimentation techniques (Mesfin, 2004).

2.7. Treatment

Generally it is advisable to use narrow spectrum anti helmentic (Flukecides) against liver flukes, because most broad spectrum anti helmenthic (against most tematodes and cestodes) have little or no effect on liver fluke. Triclabendazole (trade name, Fasinex) is highly effective against both immature and mature liver flukes at 2 dose rate of 10-12 mg /Kg (Sileshi and Dessalegn, 2007).

2.8. Control and prevention

The control of *F. Hepatic*a in cattle, sheep and goats is achieved through a combination of the control of the snail's intermediate host and the treatment of infected animals (Graber, 2008).

Snails may be controlled by the elimination of snail's habitats through the use of molluscicides and by biological control. Snail habitats can be eliminated by improved drainages and problems areas, such as drainage ditches and seepage from springs can be fenced off. Biological control through the use of ducks and frogs which ingest *L. truncatula* may be tried (Hammond and Sewell, 2004). This certainly do not eliminate molluscus but ducks may be useful on certain stretches of water molluscides can be highly effective in the control of *F. Hepatica*, copper sulphate solution 1 in 100,000 to 1 in 5 million are effective in the destruction of snails and many of their eggs.

Stock should not be grazed on treated pastures until a rain has fallen and the molluscide can be toxic to fish, Molluscides are usually applied in spring or mid-summer (Mesfin, 2004). The spring application is easy to apply and highly effective, killing off over winter infected. Snails and parent snails which would supply the nucleus of the year breeding population midsummer application kills off infected snails prior to the emergence of summer infection of F. *hepatica* on the pasture in late summer (Soulsby, 2002).

The prophylactic use of flukecides is aimed at reducing pasture contamination by fluke egg at a time most suitable for their development and removing flukes population at a time of heavy burden or at a period of nutritional and pregnancy stress to the animal. Application of the drug should be before and after rainy seasons Graber, 2008).

Preventive deworming (Drug Prophylaxis) consists of eliminating worm infections by regular treatment of herds (Flock). The treatment program should eliminate flukes at peak infection and

prevent re-infection of pasture during high risk periods. Treatment may be given at the end of dry season. The entire herd / flock should be treated. This treatment reduces infestation of pasture by residual parasites and parasites which are occur throughout the year. Two treatments per year with important anthelmetics are the main control strategy (Sileshi and Dessalegn, 2007).

3. MATERIALS AND METHODS

3.1. Description of the Study Area

The study was conducted from November 2014 to April 2015 at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir in Debre Zeit town, Ethiopia. Debre Zeit is located about 45 km South-east of Addis Ababa just on the escarpment of the Great Rift Valley and the geography of the area is marked by creator lakes. It is found at 9°N latitude and 40°E longitude and at an altitude of 1,850 meters above sea level in the central high lands of Ethiopia. It has a human population of about 117,000 (CSA, 2013). It experiences a bimodal pattern of rainfall with the main rainy season extending from June to September (Out of the annual rain fall 84% of rain) is expected in this season and a short rainy season from March to May with an average annual rainfall of 800 mm. The mean annual minimum and maximum temperatures are 12.3°C and 27.7°C, respectively, with an overall average of 18.7°C. The mean relative humidity is 61.3% (Earth networks, 2015).

3.2. Study Population

The study populations were cattle, sheep and goats of different ages and body conditions brought from different parts of the country to the abattoir for the purpose of meat production. All slaughtered animals were males. In this study, ruminants were categorized into two age groups; young (<5years) and adult (> 5years) for cattle; for sheep and goat <2 years as young and >2 years as adult based on dentations (Mebrhatu and Beka, 2011; Pace and Wakeman, 2003; Delahunt and Halbel, 1986). It was difficult to know the exact origin of the animals since they were not registered by the supplier merchants because they collect the animals from different local markets.

3.3. Study design

A cross sectional study was used to determine the prevalence, risk factors and financial loss of Fasciolosis in cattle, sheep and goats slaughtered at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir from November, 2014 to March, 2015.

3.3.1. Sample size and sampling technique

A systematic random sampling procedure was conducted to carry out this study. The sample size was proportionate among cattle, sheep and goats based on population size. The sample size for abattoirs survey was determined using the formula described in Thrusfield (2005) by using 95 % confidence interval and 5% absolute precision. In this study, the previous prevalence was considered to calculate the sample size using the following formula:

$$N = \frac{1.96^2 \, Pexp \, (1 - Pexp)}{d^2}.$$

Where: N = required sample size,

Pexp = expected prevalence

d = desired absolute precision.

Therefore, for cattle ($n = 1.96^2 \, 0.286(1-0.286)/ \, (0.05)^2 = 313$), for sheep ($n = 1.96^2 \times 0.208(1-0.208)/ \, (0.05)^2 = 253$), for goat ($n = 1.96^2 \times 0.136(1-0.136)/ \, (0.05)^2 = 182$) were obtained from the previous expected prevalence (Mekonen and Yemisrach, 2012**)** from Hashim nur's export abattoir and I added 30 animals for each species for precision. Therefore 838 animals (343 cattle, 212 goats and 283 sheep) were examined.

3.3.2. Abattoir survey

Ante mortem examination was made to classify the animal in to poor, medium and good body condition by observing the spinous process and ribcage. Routine post mortem inspection of liver and gall bladder of each animal were carried out to check for the presence of Fasciola. Livers and gallbladders were dissected carefully. Liver was inspected by making multiple deep incisions of the lobes and making a deep cut with a number of small sub cuts. Gall bladders were opened using a knife and thoroughly investigated for the presence of Fasciola and the carcass was routinely examined for the purpose of weight loses due to Fasciosis in the abattoir.

3.3.3. Economic losses of Fasciolosis

Direct economic loss was resulted from liver condemnation as the result of Fasciolosis. Generally all infected livers with Fasciolosis were unfit for human consumption. Direct economic losses refer to the losses due to condemnation of liver infested by Fasciola but indirect loss is due to carcass weight losses.

In the study, it was indicated that liver was the common organ usually infested and condemned due to Fasciolosis. As a result, economic assessment was computed for this organ as well for weight loses. Therefore, for indirect and direct lose, the estimated annual loss form carcass weight loss and organ condemnations are calculated according to the formula described by Swai and Ulicky, (2009) ; Dawit and Adem (2011) which are, ALC = ASR X LC X P and ERM = AS R X CM X BC X P X AWA

Where: ALC = Total annual liver condemnation,

ASR = average number of animal slaughtered per year in the abattoir,

LC = Mean cost of one liver,

P = Prevalence of totally condemned liver and

ERM = economic loss due to reduction of Meat,

CM = Cost of 1kg meat,

BC = Carcass weight loss in individual animal due to Fasciolosis in percentage,

P = Prevalence rate of Fasciolosis,

AWA = average weight of animals

According to Mason (2004) and Edlawit *et al* (2012) BC and AWA are 10% and 126 kg, 14.3 kg and 13.5 kg in cattle, sheep and goats respectively.

The annual economic loss was determined by considering annual average slaughter rate, the percentage of condemned organ, the average retail market price of the organs of cattle, sheep and goats, the current value of 1 kg of beef, mutton and chevon; average carcass weight of cattle, goats and sheep and percentage of weight losses due to Fascilosis. The mean retail price of bovine liver was 40 ETB and the liver of sheep and goats was 8.5 ETB and the average price of 1kg beef was 80 ETB and 95 ETB for sheep and goat meat (from record data).

3.4. Data analysis

The data which were recorded during the study period were entered into Microsoft excel sheet. Data were summarized and analyzed using SPSS version 16 computer program. The Pearson's chi-square (χ^2) test at a significance level of 5% and 95% CI was used to determine the differences in the prevalence of Fasciolosis infection among different species, age and body conditions of cattle, sheep and goats. The difference was considered as statistically significant if the p- value was less than 0.05.

5. RESULTS

5.1. Prevalence of Fasciolosis and its risk factors

The result of the present study conducted on a total of n= 838 animals in ELFORA Ethiopian Livestock and Meat Export industrialized abattoir indicated that, Fasciolosis is highly prevalent with the overall prevalence of 21.8%. The specific prevalence of Fasciolosis was found to be 30.6% in cattle, 20.1 % in sheep and 9.9% in goats and there was statistically significant difference (P<0.05) on the prevalence of Fasciolosis with respect to the species of the animal (Table 1).

Table 1: Prevalence of Fasciolosis among cattle, sheep and goats

Species of animal	**No. of examined animals**	**Positive**	**Prevalence (%)**	**χ^2 - value**	**P-value**
Cattle	343	105	30.6%	33.632	0.000
Sheep	283	57	20.1%		
Goat	212	21	9.9%		
Total	**838**	**183**	**21.8%**		

There was statistically significant difference (P< 0.05) on the prevalence of Fasciolosis between different age groups of animals and the prevalence was 28.0% in adult cattle, sheep and goats and 15.4 % in young cattle, sheep and goats (Table 2).

Table 2: Prevalence of Fasciolosis among animals of different ages

Age	**No. of examined animals**	**Positive**	**Prevalence (%)**	**χ^2 - value**	**P-value**
Adult	429	120	28.0%	19.378	0.000
Young	409	63	15.4%		
Total	**838**	**183**	**21.8%**		

The Result of the present study showed that there was statistically significant variation in the prevalence of Fasciolosis with respect to young and adult cattle and their prevalence were 22.6% and 38.3% respectively. The prevalence of Fasciolosis was 13% and 26.9% in young and adult sheep respectively and 6.8% and 12.8%, in young and adult goats respectively (Table 3).

Table 3. Prevalence of Fasciolosis in cattle, sheep and goat based on age**.**

Species	**Age**	**No. Examined animals**	**Positive**	**Prevalence**	χ^2**-value**	**P- value**
Cattle	Young	168	38	22.6%	9.904	0.002
	Adult	175	67	38.3%		
	Total	**343**	**105**	**30.6%**		
Sheep	Young	138	18	13%	8.436	0.005
	Adult	145	39	26.9%		
	Total	**283**	**57**	**20.1%**		
Goat	Young	103	7	6.8%	2.17	0.171
	Adult	109	14	12.8%		
	Total	**212**	**21**	**9.9%**		

Higher prevalence of Fasciolosis was observed in poor body condition group of animals followed by medium body condition and the lowest prevalence of Fasciolosis was recorded in good body condition animals with the prevalence rate of 29.6%, 20.2% and 14.5% respectively. Statistical analysis of the data showed that, there were significant difference ($p<0.05$) on the infestation of ruminants with prevalence of Fasciolosis among the three different body conditions of the examined animals (Table 4).

Table 4: Prevalence of Fasciolosis among animals of different body conditions

Body condition	**No. of examined animals**	**Positive**	**Prevalence (%)**	**χ^2- value**	**P-value**
Good	220	32	14.5%	17.153	0.000
Medium	341	69	20.2%		
Poor	277	82	29.6%		
Total	**838**	**183**	**21.8%**		

There was statistically significance difference ($p<0.05$) for the prevalence of Fasciolosis in poor, medium and good body condition cattle with the prevalence rate of 41.6%, 28.6% and 20.6%, respectively. The prevalence of Fasciolosis in poor, medium and good body condition sheep was 27.2%, 19 % and 13.3% respectively and in poor, medium and good body condition goats it was 13.9%, 9.8% and 4.2% respectively. There was no significance difference ($p>0.05$) in the prevalence of Fasciolosis in sheep and goats among different body conditions (Table 5).

Table 5. Prevalence of Fasciolosis in cattle, sheep and goat based on body condition.

Species	**Body condition**	**No. of examined animals**	**positive**	**prevalence**	**χ^2-value**	**P- value**
Cattle	Poor	113	47	41.6%	11.236	0.04
	Medium	133	38	28.6%		
	Good	97	20	20.6%		
	Total	**343**	**105**	**30.6%**		
Sheep	Poor	92	25	27.2%	5.090	0.08
	Medium	116	22	19%		
	Good	75	10	13.3%		
	Total	**283**	**57**	**20.1%**		
Goat	Poor	72	10	13.9%	3.053	0.233
	Medium	92	9	9.8%		
	Good	48	2	4.2%		
	Total	**212**	**21**	**9.9%**		

5.2. Financial loss of Fasciolosis

5.2.1. Direct Economic loss

In the study abattoir the average annual cattle, sheep and goats slaughtered rate was estimated to be 36,000, 59,000 and 288,000 while the mean retail price of bovine liver was 40 ETB and the liver of sheep and goats was 8.5 ETB. Prevalence of Fasciolosis in ELFORA export abattoir estimated as 30.6%, 20.14% and 9.9% for cattle, sheep and goats, respectively. Therefore the estimated annual loss form organ condemnation is calculated according to the formula: ALC = CSR X LC X P.

A computed direct economic loss from condemned livers is 784,477 ETB /39,223.85 USD (Table 6).

5.2.2. Indirect Economic loss

Indirect economic loss is due to carcass weight reduction as result of Fasciola infestation. In the study area the average price of 1kg beef was 80 ETB and 9 ETB for sheep and goat meat each. The indirect economic loss reduction due to bovine Fasciolsis is calculated by using the formula:

ACW = CSR X CL X BC X P X AWA.

Therefore, the total monetary loss incurred through carcass yield of losses in cattle, sheep and goats were 16,455,385 ETB /822,769.25USD (Table 6).

Table 6. Computed economic losses due to Fasciolosis.

Cattle, sheep and goat	**Computed values**	**Ethiopian Birr (ETB)**	**United States Dollar (USD)**
Liver(cattle, sheep ,goats)	ALC=36,000X40ETBX0.306=440,640ETB, ALC = 59,400 X 8.5 ETB X 0.201 = 101,485 ETB and ALC = 288,000 X 8.5 ETB X0.099 = 242,352 ETB respectively for cattle, sheep and goats.	784,477	39,223.85
Cattle carcass	36,000X 30.6 % X 126 kg X 10 % X80 ETB ETB	11,104,128	555206.4
Sheep carcass	59,400X 20.14 % X 14.3 kg X 10 % X95 ETB	1,694,593	84,729.65
Goats carcass	288,000X 9.9 % X 13.5 kg X 10 % X95 ETB	3,656,664	182833.2
Total		**17,239,862**	**861,993.1**

6. DISCUSSION

The overall prevalence of Fasciolosis in the study was 21.8%. The specific prevalence of Fasciolosis was found to be 30.6% in cattle; 20.14 % in sheep and 9.9% in goat. Statistical analysis of the data showed that there was significant difference ($P<0.05$) on the prevalence of Fasciolosis among cattle, sheep and goats. This result is greater than the finding of Mekonen and Yemisrach (2012) and Henok and Mekonen (2011) who reported as 28.6%, 20.8% and 13.6% in cattle, sheep and goats and 14.6% and 8.8% in sheep and goats, respectively. However it is lower than the results of previous study conducted by Tigre and Tolosa (2007) and Abebe *et al*. (2011) who reported a prevalence of 46.58% and 53.68% Fasciolosis on postmortem examination of livers from Jimma and Agaro municipal abattoirs, respectively. Similarly, prevalence's were recorded as high as 80% and as low as 4.9% by Dagne (1994) and Abunna *et al*. (2010) from Debre Berhan (central highland areas) and Wolaita Soddo (Southern highland), respectively. The reason for these variations in the prevalence of Fasciolosis might be due to the differences in temperature, moisture, humidity, soil that might favor multiplication of intermediate host, snails, the different parasitological techniques used in these studies, differences in the origin of the samples and/or geographical differences. The variation in the prevalence of Fasciolosis among those species may be also explained by the fact that cattle and sheep have indiscriminate type of grazing behavior and goats are selective grazers which reduced the chance of exposure to infective stage of Fasciola which is commonly found on grasses around marshy areas.

The Result of the present study showed that there was statistically significant variation in the prevalence of Fasciolosis with respect to young and adult cattle and their prevalence were 22.6% and 38.3% respectively. This result is slightly less than the findings of Mekonen and Yemisrach (2012) from Helimex abattoir, who reported 39.8% and 23.3% in young and adult cattle respectively. This may be due to implementations of control strategies over the periods in the study areas and difference in ecology of animal origin.

The present study according to age groups had no significant difference ($P > 0.05$) but their prevalence were different. The prevalence of Fasciolosis was 13% and 26.9% in young and adult sheep respectively and 6.8% and 12.8%, in young and adult goats respectively. This is higher than the reports of Hiko and Kifle (2011) who reported 9.6% and 5.5% in adult and young sheep and

4.5% and 1.25% in adult and young goats. The higher prevalence of Fasciolosis in adults could be best explained by the fact that young animals are usually kept in door or around the home and are not allowed to go far with adult animals for grazing so that they have reduced chance of exposure to infective parasitic stages when compared to adults.

The results of the present study indicated that body condition of the cattle has significant association with the occurrence of Fasciolosis. The prevalence was higher in poor body conditioned animals followed by medium and good body conditioned animals with the prevalence rate of 41.6%, 28.6% and 20.6%, respectively. This result agrees with the report of Mekonen and Yemisrach (2012) in Hashim Nur's export abattoir and Alemu and Mekonen (2014) in Dangila municipal abattoir who reported 38.1%, 30% and 24.2% and 46.5%, 38.5% and 22.5% respectively. The probable reason could be due to the fact that animals with poor body condition are usually less resistant and are consequently susceptible to various diseases including Fasciolosis and due to reduced performance of the animals created by lack of essential nutrients and poor management by the owners.

The prevalence of Fasciolosis in poor, medium and good body condition sheep were 27.2%, 19 % and 13.3% respectively and in poor, medium and good body condition goats was 13.9%, 9.8% and 4.2% respectively. There was no significance difference ($p>0.05$) in the prevalence of Fasciolosis in sheep and goats among different body conditions. Even though there were no significance variations, there was higher prevalence variation among different body condition accounting poor body condition the first followed by medium and good body condition in small ruminants which agrees with the finding of Henok and Mekonen (2011) in around Hirna town and Yemisrach and Mekonen (2012) in helimex abattoir, who reported 16.5%, 11.6% and 2.3% in sheep and 28.8%, 20.5%, 14.3% and 13.6%, 11% and 7.2% in sheep and goats respectively. This finding confirms the importance of Fasciolosis in causing weight loss and emaciation as a characteristic sign of the disease. The high prevalence of Fasciolosis infestation in poor body conditioned animals is due to poor body condition animals are vulnerable to parasitic diseases.

The direct monetary loss as a result of condemnation of liver of cattle and indirect monetary loss due to carcass weight reduction incurred during this study was estimated to be 784,477 ETB /39,223.85 USD and 16,455,385 ETB /822,769.25USD per annum, respectively. Therefore, the total annual

monetary loss due to Fasciolsis in the study abattoir is the summation of losses from organ condemnation and carcass weight reduction which is 17,239,862 ETB/861,993.1USD per annum. The monetary loss in the present study was higher than the results of Edilawit *et al* (2012) in Jimma municipal abattoir, Mihreteab *et al*. (2010) at Adwa municipal abattoir and Rahmeto *et al*., (2010) at Hawassa municipal abattoir who calculated monetary loss of Fasciolosis to be 1,574,482 ETB/87,471 USD, 4,672 USD and 106,400 ETB respectively. The difference in the estimated economic losses could be attributed to the increase in the price of liver and meat in the global market in general and in Ethiopia in particular.

7. CONCLUSSION AND RECOMENDATIONS

Results of the present study showed that; the overall prevalence of Fasciolosis in all slaughtered animals was 21.8% with the specific prevalence of 30.6%, 21.1% and 9.9% in cattle, sheep and goats respectively which is conducted at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir in Debre Zeit town, Ethiopia. There was significant difference in the prevalence of Fasciolosis among the different species, ages and body condition scores of examined cattle, sheep and goats and it is shown that Fasciola parasites were proved to be more prevalent in ruminants with poor body condition scores and adults than medium and good body conditioned and young animals. The high level of Fasciolosis in cattle, sheep and goats in the present study represent high rate of infestation and immense economic losses to the country.

In line with this finding I recommended that;

- Farmers who rear cattle, sheep and goats should improve provision of feeds to their animals so that the animal can have good body condition that confers some level of resistance against fasciolosis.
- The farmers should be able to regularly treat their animals with the appropriate anthelementics.
- The abattoirs which import the animals from different part of the country should have well documented profile of the animal where they originate which helps to control the disease.
- Education and awareness creation about the effects of fasciolosis and the associated financial losses should be extended to farmers.

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9. ANNEXES

Annex 1: data recording format

S. No.	Date	species	Age	Body condition score	Result

Annex 2: body condition score criteria

- ☑ Poor: - smooth and prominent spinouts and transverse process flaggers can be pushed moderate deapth on loin muscle.
- ☑ Medium: - spinous process pushed up smooth and moderate fat loin muscle.
- ☑ Good: - spinous process pushed up smooth and high fat lion muscle.

Source: (Nicholson and Butter worth, 1986 and Girma A., 2007)

10. DECLARATION

I**,** the under signed, declare that the information presented here in my thesis is my original work, has not been presented for degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

Name: _____

Signature: _____

Date of submission: _____

This thesis has been submitted for examination with my approval as university advisor

Name: _____

Signature: _____